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Note on the Latitude of the Royal Observatory, Cape of Good Hope. By David Gill, LL.D., F.R.S., Her Majesty's Astronomer at the Cape.

In the introduction to the Cape Catalogue for 1885, recently printed, there is given a discussion of the systematic errors of the Declinations of the Greenwich Ten-Year Catalogue and the Cape General Catalogue for 1885.

The results of that discussion show that if the co-latitudes are

$$\begin{array}{llll} & \circ & \prime & \prime\prime \\ \text{For Greenwich} & 38 & 31 & 21{\cdot}90+X, \\ \text{,, Cape} & 123 & 56 & 3{\cdot}35+x; \end{array}$$

then

$$X=-0''{\cdot}103; \qquad x=+0''{\cdot}186.$$

Further, the refractions of the *Tabulæ Regiomontanæ* require to be multiplied by the following factors :—

$$\left.\begin{array}{ll} \text{At Greenwich by} & (1-0{\cdot}00217) \\ \text{,, the Cape by} & (1-0{\cdot}00218) \end{array}\right\} \text{The zenith distances being limited to } 80^\circ.$$

The general accuracy of these interdependent results has been remarkably confirmed as follows :—

As an independent control on the system of declinations, a number of pairs of stars was selected for observation with the zenith telescope, and some years ago a list of these pairs of stars was forwarded to Dr. Otto Struve (then Director of the Pulkowa Observatory), with a request that the northern stars of the list should be observed at Pulkowa, either by referring them to the Pulkowa fundamental stars with the transit circle, or observing them fundamentally with the vertical circle.

Dr. Struve expressed the opinion that for such work he considered the vertical circle should be employed; that Dr. Nyrén was unable to undertake observations of the complete list with the vertical circle, but had promised to observe a list of twenty-two stars of special importance, and he hoped that Dr. Romberg would be able to observe the others with the transit circle.*

These twenty-two northern stars were selected in such a way that for each of eleven southern circumpolars there should be one northern star forming a Talcott-latitude pair with it at upper culmination, and another at lower culmination. The twenty-two

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* I am since informed that Dr. Romberg has observed these stars with the transit circle, but the results have not yet reached me.

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Talcott pairs thus formed were observed with the zenith telescope at the Cape, and the twenty-two northern stars were observed by Dr. Nyrén with the vertical circle at Pulkowa. The results of Dr. Nyrén's observations were kindly communicated by him on 1889 March 9, and are also published in the *Astronomische Nachrichten*, No. 2904.

In the mean of two latitude pairs, in one of which the south component is a circumpolar star at upper transit, and in the other pair the southern star is the same circumpolar at lower transit, it is clear that the mean declination of the south stars (apart from change of latitude between the epochs of observation of the two pairs) must be rigorously = 90°. The deduced latitude from pairs thus combined will therefore rest entirely on the Pulkowa declinations, and be independent of errors in the assumed places of the southern circumpolars.

The results are based on four observations of each northern star at Pulkowa, and on ten to twelve observations of each pair with the zenith telescope at the Cape.

The Cape observations extend from 1886 to 1891, and the effect of change of latitude is practically eliminated, as is shown by the results with and without Chandler's corrections for change of latitude.

With the places of the northern stars given in the *Ast. Nach.*, No. 2904, the reduction of the observations gives (Introduction to Cape Catalogue for 1885·0, pp. xlvi, xlvii)

	°	′	″
Latitude of the Cape transit circle...	−33	56	3·65
The latitude derived from the discussion of the Cape and Greenwich transit-circle observations being			3·54
Difference			0·11

But within the past few days the Pulkowa Observations, Series II. vol. i., has reached the Cape. In the list of stars occasionally observed Dr. Nyrén there gives the finally discussed positions of the twenty-two northern stars. Employing these corrected positions in lieu of those published in the *Ast. Nach.*, No. 2904, the latitude of the Cape comes out

	°	′	″
	−33	56	3·57
Or, as above, from the meridian observations			3·54
Difference			0·03

This remarkable agreement between results arrived at by methods, instruments, and observers so entirely distinct from each other cannot but be regarded as extremely satisfactory. The separate results are given below :—

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South Star.	North Star.	Excess of North Z.D. 1887·0.	Resulting Latitude. Without Chandler's Corrections.	Resulting Latitude. With Chandler's Corrections.
		″	° ′ ″	″
Brisb. 4091 S. P.	Pulk. (1855) 115	+229·04	−33 56 3·50	3·49
Brisb. 4091	Pulk. (1855) 1829	−501·03		
Stone 7461 S. P.	W$_2$ 1^h 758–60	+345·30	3·27	3·25
Stone 7461	Pulk. (1855) 1927	+517·07		
Lac. 1848	Pulk. (1855) 475	− 50·76	3·49	3·50
Lac. 1848 S. P.	Pulk. (1855) 2202	−383·19		
Stone 9273 S. P.	Arm.$_2$ 573	+503·25	3·55	3·53
Stone 9273	Pulk. (1855) 2483	−254·21		
Lac. 1839	Pulk. (1855) 732	−307·52	3·93	3·93
Lac. 1839 S. P.	Pulk. (1855) 2417	− 9·06		
Stone 2901	Pulk. (1855) 1052	+264·89	3·64	3·62
Stone 2901 S. P.	Pulk. (1855) 2603	+ 67·07		
σ Octantis S. P.	Pulk. (1855) 1148	−201·22	3·73	3·74
σ Octantis	Pulk. (1855) 2706	+423·58		
A Octantis	Pulk. (1855) 1196	−492·94	3·40	3·38
A Octantis S. P.	Lalande 37406–7	− 48·63		
τ Octantis S. P.	Arm.$_2$ 1259	− 91·51	3·51	3·50
τ Octantis	Arm.$_2$ 3116	+279·08		
Lac. 4578	W$_2$ 10^h·1118	−313·33	3·65	3·62
Lac. 4578 S. P.	Arm.$_2$ 3084	−127·62		
Stone 6404	Pulk. (1855) 1719	+118·21	3·75	3·72
Stone 6404 S. P.	Pulk. (1855) 3403	− 80·61		
	Means... ...	... ...	−33 56 3·58	3·57
	Probable Error	... ...	±0·04	±0·04

Royal Observatory, Cape of Good Hope:
1894 *October* 16.

Preliminary Note on the Position of the Liverpool Observatory.
By W. E. Plummer, M.A.

In the Annual Report of the Council for the year 1867 it is stated: "From five transits of *β Draconis*, four of *γ Draconis*, and one of *α Cygni*, each of them over the east and west prime verticals, the latitude (of the Liverpool Observatory) is 53° 24′ 3″·8 N." As far as I know, no details have ever been published, nor can I find in the archives of the Observatory any record of the observations.

It was with the view of confirming this result, and also to test how far the instrument was available for the accurate determination of latitude, that the following observations were undertaken.

The Observatory is not equipped with a transit circle, but a third pier has been erected to the north of the eastern pier at right angles to the meridian, and at such a distance as to permit the transit instrument being placed between this and the eastern pier. The Y bearings and the mounting generally are in all respects similar to those employed when the instrument is on the meridian. The new position of the line of collimation is 1 foot 8 inches north of the ordinary transit.

The means for reversal of the instrument are not convenient, and the operation cannot be effected under about three minutes, so that it is only for stars which cross within a few minutes of the zenith that it is possible to reverse the telescope during the transit. Practically the instrument has only been reversed for the determination of collimation, and the whole of the transit has usually been made in either the north or the south position. Neither could the telescope be used as a zenith instrument in the ordinary Talcott or Horrebow method. For these reasons it has been necessary to rely on pairs of observations of the same stars made on different nights in reversed positions of the axis.

It was originally intended to bisect the star when near the prime vertical by the micrometer wire, noting the time; but this method had to be abandoned, not only because the micrometer was in a very inconvenient position for reading when the telescope was nearly vertical, but the earlier observations so made showed that there was some loss or irregularity in the screw which it was impossible to make entirely disappear. These observations have accordingly all been rejected, and those observations only have been retained which depend upon transits over the fixed wires of the instrument.

These are nine in number, and under the most favourable circumstances could only give four contacts in each reversed position of the instrument—another reason for not reversing during each transit. The intervals between these wires, when de-